Center Innovation Fund: MSFC CIF

Towards In-Space Additive Manufacturing of Thermosets and Embedded Fibers

Completed Technology Project (2015 - 2016)

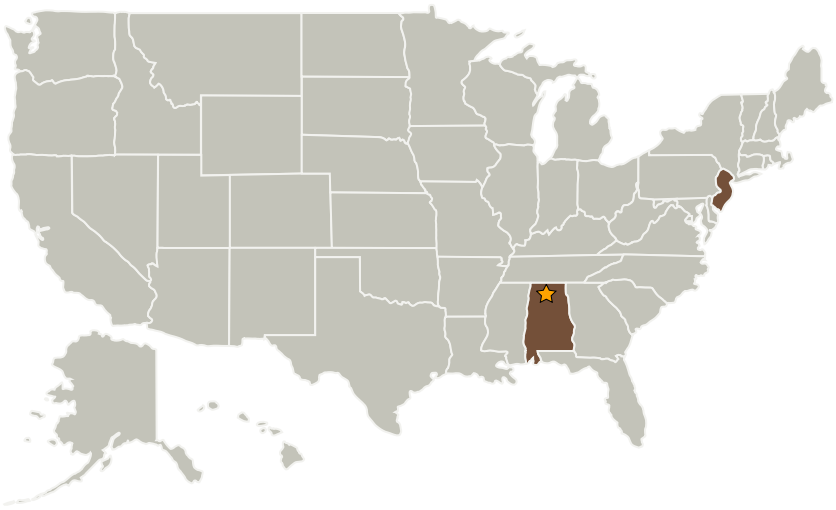
Project Introduction

It is proposed to overcome current deficiencies in ISAM by developing thermal-curing thermosets with embedded fibers, and to move this new technology toward commercial feasibility. The work involves exploring benefits of low-gravity for innovative control of liquid spreading during extrusion, and quantifying the proper conditions for embedding composite fibers in the thermosets. The proposed effort includes these technical tasks: (i) Develop analytical simulations of the proposed ISAM methodology. (ii) Extrude droplets, puddles, and linear beads of thermal-curing thermosets on heated surfaces, and compare to simulations. (iii) Use calibrated models to predict performance in varied-gravity environments. (iv) Embed composite fibers into extruded thermosets using a modified 3D printer.

Anticipated Benefits

In the future, this work in design and predictive modeling will be useful for AM and deposition of new materials beyond thermal-curing thermosets with embedded fibers, such as recycled feedstock, concrete, high-temperature thermoplastics, and even regolith.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Rutgers University-New Brunswick	Supporting Organization	Academia	New Brunswick, New Jersey

Primary U.S. Work Locations	
Alabama	New Jersey

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Center Innovation Fund: MSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

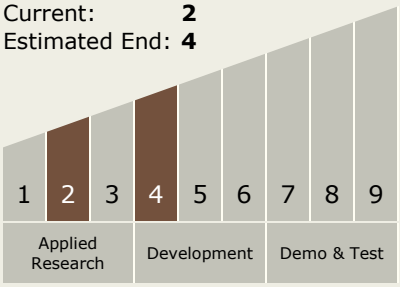
John W Dankanich

Principal Investigator:

Patrick V Hull

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **4**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes